Consommation et Corporations Canada
Bureau des brevets
Ottawa, Canada
K1A 0C9

Consumer and Corporate Affairs Canada
Patent Office

(11) (C) **1,287,191**
(21) 518,716
(22) 1986/09/22
(45) 1991/07/30
(52) 358-22

(51) INTL.CL.[5] G21K-5/02; A61L-2/08

(19) (CA) **CANADIAN PATENT** (12)

(54) Process for the Irradiation of Large Units of Objects to be Irradiated by Means of Ionizing Radiation

(72) Tetzlaff, Karl-Heinz , Germany (Federal Republic of)

(73) Same as inventor

(30) (DE) Germany (Federal Republic of) P 35 33 826.1 1985/09/23

(57) 5 Claims

Canada

Process for the Irradiation of Large Units of Objects to Be Irradiated by Means of Ionizing Radiation

The invention relates to a process for the irradiation of objects to be irradiated with gamma or X-rays. The invention is particularly suitable for the irradiation of disposable healthcare articles and foodstuffs which have been assembled into large shipping units. As known from the state of the art, ionizing radiation can, e.g. destroy micro-organisms and harmful insects or alter the characteristics of foodstuffs or fodder.

With increasing use of this technology, the shipping units to be irradiated grew increasingly larger due to more rational handling. A shipping unit herein refers to an arrangement of objects to be irradiated which are moved as one unit within an irradiation apparatus. Typical shipping units are cartons, crates, barrels or objects to be irradiated stacked on pallets. With increasing size and/or density the irradiation becomes uneven. The irradiation efficiency may also distinctly decrease as the weight of the shipping units increases.

Irradiation efficiency, or for short efficiency, refers to the exploited part of the entire emitted radiation, whereby that part of the dosage in the objects to be irradiated that lies

*

above minimum dosage is considered not exploited. The ratio of maximum to minimum dosage within a shipping unit is selected as the degree of dosage uniformity.

The object of the invention is to improve the efficiency and dosage uniformity when large shipping units are employed.

The object of the invention is accomplished in that the objects to be irradiated are arranged in such a manner that the average density in the center is less than in the peripheral area and the radiation enters from at least two main directions.

Any type and shape of radiation source may be used. Moreover, the process is suitable for every type of movement of the objects to be irradiated about the source of radiation which is also suitable for the irradiation of shipping units having uniform density. There may also be additional objects to be irradiated between the source of radiation and the shipping unit, which weakens the radiation for part of the shipping unit or the entire shipping unit. Any type of shielding devices which are intended to improve dosage uniformity may also be continued to be used. It is, however, to be noted that dosage uniformity is already markedly improved by the invented process. The effect of the shielding devices may therefore be reduced.

The invented process is particularly effective when the radiation penetrates the objects to be irradiated from at least 4 directions. Irradiation from 4 directions may occur in that, e.g. a cuboid shipping unit is turned 90 degress each time. The radiation then enters the objects to be irradiated through the 4 sides of

of the superficies. The objects to be irradiated may also be irradiated from all directions, e.g. by means of continually rotating a shipping unit. The invented process is, however, not limited to an irradiation from all sides by the means of rotating or moving the shipping unit. In addition to irradiating from the sides, it is also possible to irradiate from above or below. A similar apparatus is described in, e.g. DE 2 147 088.

The inner area in the center o a shipping unit, which has less density than the peripheral area, may have different shapes. The shape of the inner area depends on the number of sides from which the radiation enters the objects to be irradiated.

For better understanding, the following description assumes that the objects to be irradiated are arranged in small cartons on a commercial pallet and a long vertical source of radiation is employed or that the shipping unit is conveyed vertically at some point. The inner area is considered empty.

In the case of two-sided irradiation, only two walls are formed with these cartons which confine the shipping unit in the direction of the incoming radiation.

In the case of irradiation from at least four sides through the lateral surfaces, e.g. through the superficies, the cartons are stacked to form a closed wall on all 4 sides.

In the case of at least four-sided irradiation through the lateral surfaces and addtional irradiation from above and below, the cartons are stacked in such a manner that a closed inner area is created which is free of objects to be irradiated. This inner area is thus comprised of 4 walls, a floor and a ceiling. The inner area is created, e.g. in that an empty carton is simply placed in the center. The additional irradiation from a third di-

mension may be realized by means of additional sources of radiation or by tilting the shipping unit.

The size of the inner area depends on the size of the shipping unit being used, the density of the objects to be irradiated and the penetration capacity of the radiation source being employed, moreover, also whether the shipping units are conveyed past the radiation source in one row or two. Two rows means herein that 2 shipping units are irradiated in a tandem arrangement.

An inner area having little density is usually not profitable for small shipping units and large shipping units having little density, because irradiation efficiency is reduced and only an improved dosage uniformity is attained. When using Co-60 as the source of radiation and irradiation is from 4 directions in a single row arrangment, an examination is recommended when the density of the product and the thickness to be irradiated exceeds a value of approx. 10 to 20 g/cm^2.

The density of the inner area may decrease continually or in several steps toward the center. This can be achieved in that, e.g. the same product is packaged with more intermediate space. Often, however, an abrupt drop in density for the inner area is more practicable, preferably a reduction in density to a density of "0".

The invention is described by way of an illustrative embodiment in figures 1 to 4 as follows:

Fig.1 shows a view with a rod-shaped radiation source and several shipping units of objects to be irradiated stacked on top of each

other.

Fig. 2 shows a top view of Fig. 1.

Fig. 3 and Fig. 4 show the efficiency and dosage uniformity as a function of the density of the inner area by way of an example.

Fig. 1 illustrates a vertically arranged rod-shaped Co-60 radiation source 1, which is hanging on a steel rope 2. As Fig. 2 also shows, radiation source 1 is surrounded by 4 racks 3 having 4 shelves each, on which pallets 4 having the dimensions 120x120cm are placed, which are loaded 150cm high with objects to be irradiated 5 having a density of 0.6 g/cm^3. The right side of Fig.1 illustrates a cross-section of rack 3. Objects to be irradiated 5 have an inner area 6 having the dimensions of 60x60x1.5cm, which may be filled with a density ranging between 0 and 0.6g/cm^3. Racks 3 stand on rotatble platforms 7, which turn 90 dgrees in 4 intervals following each loading and unloading of objects to be irradiated so that objects to be irradiated 5 are uniformly irradiated from 4 sides. On the left side of Fig. 1 are arrows indicating the manner in which the objects to be irradiated may be loaded and unloaded. First the bottom shipping unit consisting of a pallet 4 and objects to be irradiated 5 is removed. The remaining shipping units are then lowered one story. Then an unirradiated shipping unit may be placed in the top shelf which has become empty. The handling of the shipping units is in the state of the art manner of conveyance technology.

Fig. 3 illustrates the calculated efficiency in relative units

2-1

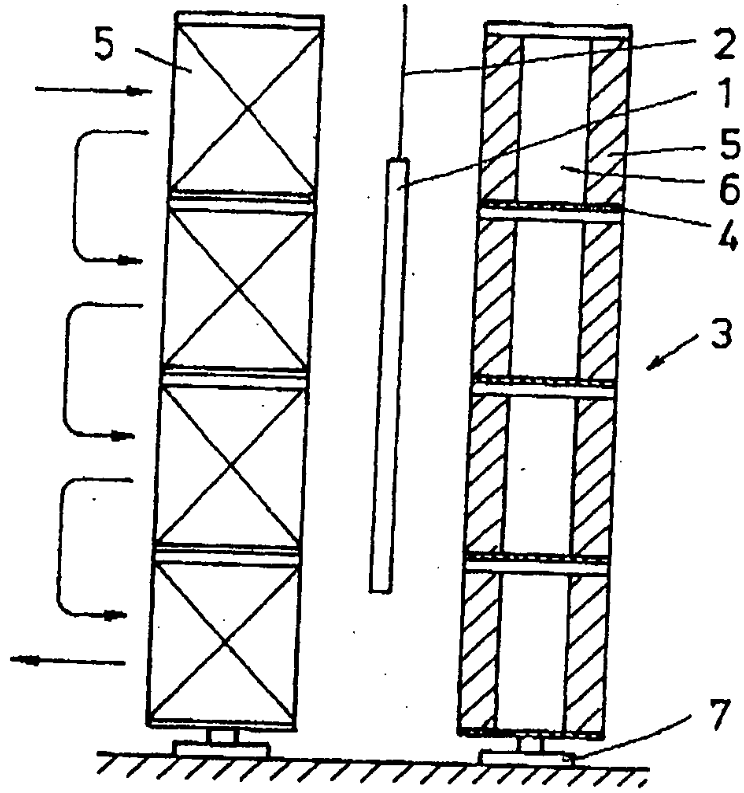

Fig. 1

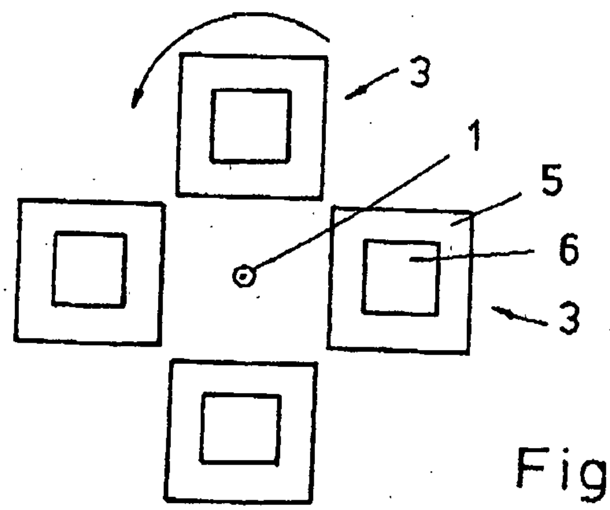

Fig. 2

BELL & ARKIN

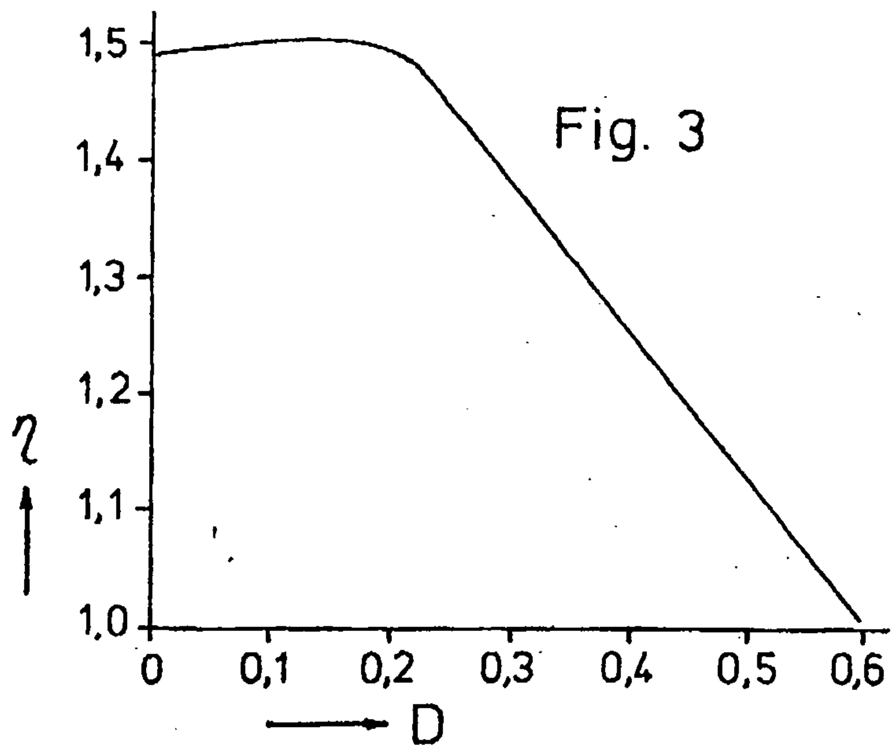

Fig. 3

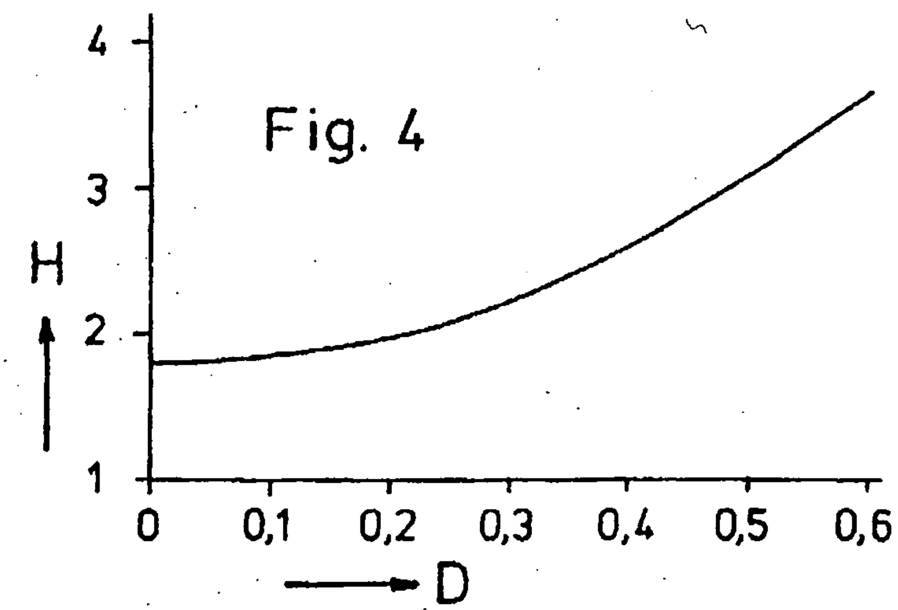

Fig. 4

BELL & ARKIN